Goodman Manufacturing Company, L.P.
1810 Wilson Parkway / Fayetteville, TN 37334
(888) 593-9988
FAX (931) 438-2273

TECHNICAL
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LONG LINE SET APPLICATION R-410A

- Only allow qualified, experienced technicians to install or service this unit.
- Units must be installed in accordance with Regulations of the National Fire Protection Association and applicable local codes. Where local regulations are at a variance with instructions, installer should adhere to local codes
- Before connecting tubing, read the outdoor unit installation manual. Pay particular attention to all safety precautions.

ATTENTION INSTALLING PERSONNEL

As a professional installer you have an obligation to know the product better than the customer. This includes all safety precautions and related items.
Prior to actual installation, thoroughly familiarize yourself with these guidelines. Pay special attention to all safety warnings posted on the equiment. Often during installation or repair it is possible to place yourself in a position which is more hazardous than when the unit is in operation.
Remember, it is your responsibility to install the product safely and to know it well enough to be able to instruct a customer in its safe use.
Safety is a matter of common sense...a matter of thinking before acting. Most dealers have a list of specific good safety practices...follow them.
The precautions listed in this Installation Manual are intended as supplemental to existing practices. However, if there is a direct conflict between existing practices and the content of this manual, the precautions listed here take precedence.

This long line set application guideline applies to all AHRI listed R-410A air conditioner and heat pump split system matches of nominal capacity 18,000 to 60,000 Btuh. This guideline will cover installation requirements and additional accessories needed for split system installations where the line set exceeds 80 feet in actual length.

Accessories For Lines Greater Than 80 Feet:

1. **Crankcase Heater**- a long line set application can critically increase the charge level needed for a system. As a result, the system is very prone to refrigerant migration during its off-cycle and a crankcase heater will help minimize this risk. A crankcase heater is required for any long line application (50 watt minimum).

2. **For** all line set applications over 80 feet a TXV is recommended. The subcooling should be 6º ± 2º.

3. **Hard Start Assist**- increased charge level in long line applications can require extra work from the compressor at start-up. A hard start assist device may be required to overcome this.

4. **Liquid Line Solenoid** - a long line set application can critically increase the charge level needed for a system. As a result, the system is very prone to refrigerant migration during its off-cycle and a liquid line solenoid will help minimize this. A liquid line solenoid is recommended for any long line application on straight cooling units.

Tube Sizing:

1. In long line applications, the "equivalent line length" is the sum of the straight length portions of the suction line plus losses (in equivalent length) from 45 and 90 degree bends. **Select the proper suction tube size based on equivalent length of the suction line (see Tables 2 & 3) and recalculated system capacity.**

TABLE 1.

Equivalent length = $\text{Length}_{\text{horizontal}}$ + $\text{Length}_{\text{vertical}}$ + Losses from bends (see Table 3)

Example using ¾" elbow:

150 feet of straight tubing + (four short radius elbows x 1.7) + (2 long radius elbows x 1.5) = 150 + 3.4 +3 = 156.4 equivalent feet.

2. **For any residential split system installed with a long line set, 3/8" liquid line size must be used.** Limiting the liquid line size to 3/8" is critical since an increased refrigerant charge level from having a larger liquid line could possibly shorten a compressor's lifespan.

3. **Single Stage Condensing Unit:** The maximum length of tubing must not exceed 150 feet.

   - **80 feet** is the maximum recommended vertical difference between the condenser and evaporator when the evaporator is above the condenser. Equivalent length is not to exceed 150 feet.
   - The vertical difference between the condenser and evaporator when the evaporator is below the condenser can approach 150 feet, as long as the equivalent length does not exceed 150 feet.
   - The distance between the condenser and evaporator in a completely horizontal installation in which the indoor and outdoor unit do not differ more than 10 feet in vertical distance from each other can approach 150 feet, as long as the equivalent length does **not exceed 150 feet.**

4. **Two-Stage Condensing Unit:** The maximum length of tubing must not exceed 80 feet where indoor coil is located above the outdoor unit.

   NOTE: When the outdoor unit is located above the indoor coil, the maximum vertical rise must not exceed 25 feet. If the maximum vertical rise exceeds 25 feet, premature compressor failure will occur due to inadequate oil return.

Most refrigerant tubing kits are supplied with 3/8"-thick insulation on the vapor line. For long line installations over 80 feet, especially if the line set passes through a high ambient temperature, ½"-thick suction line insulation is recommended to reduce loss of capacity. The liquid line should be insulated if passing through an area of 120°F or greater. Do not attach the liquid line to any non-insulated portion of the suction line.

5. **Vibration and Noise:** In long line applications, refrigerant tubing is highly prone to transmit noise and vibration to the structure it is fastened to. Use adequate vibration-isolating hardware when mounting line set to adjacent structure.

Table 2 below lists multiplier values to recalculate system-cooling capacity as a function of a system's equivalent line length (as calculated from the suction line) and the selected suction tube size. Table 3 lists the equivalent length gained from adding bends to the suction line. **Properly size the suction line to minimize capacity loss.**

TABLE 2. CAPACITY MULTIPLIERS AS A FUNCTION OF SUCTION LINE SIZE & EQUIVALENT LENGTH

Unit	Suction Dia (in)	Capacity					
		Length (ft)					
		25	50	75	100	125	150
18000	1/2	0.99	0.97	0.96	0.94	0.94	0.93
	5/8	1.00	0.99	0.99	0.99	0.98	0.98
	3/4	**1.00**	1.00	1.00	1.00	0.99	0.99
24000	5/8	0.99	0.99	0.98	0.98	0.97	0.97
	3/4	**1.00**	1.00	0.99	0.99	0.99	0.99
	7/8	1.00	1.00	1.00	1.00	0.99	0.99
30000	5/8	0.99	0.99	0.98	0.97	0.96	0.96
	3/4	**1.00**	1.00	0.99	0.99	0.99	0.98
	7/8	1.00	1.00	1.00	1.00	1.00	0.99
36000	5/8	0.99	0.98	0.96	0.95	0.94	0.93
	3/4	1.00	1.00	0.99	0.99	0.98	0.98
	7/8	**1.00**	1.00	1.00	1.00	0.99	0.99
	1 1/8	1.00	1.00	1.00	1.00	1.00	1.00
42000	3/4	1.00	0.99	0.99	0.98	0.97	0.97
	7/8	1.00	1.00	0.99	0.99	0.99	0.99
	1 1/8	**1.00**	1.00	1.00	1.00	1.00	1.00
48000	3/4	0.99	0.99	0.98	0.97	0.96	0.96
	7/8	1.00	0.99	0.99	0.99	0.98	0.98
	1 1/8	**1.00**	1.00	1.00	1.00	1.00	1.00
60000	3/4	0.99	0.98	0.97	0.96	0.94	0.93
	7/8	1.00	0.99	0.98	0.98	0.97	0.97
	1 1/8	**1.00**	1.00	1.00	0.99	0.99	0.99

NOTE: For a condenser with a liquid valve tube connection less than 3/8" diameter, use 3/8" liquid line tubing for a line set greater than 25 feet.

TABLE 3. LOSSES FROM SUCTION LINE ELBOWS (EQUIVALENT LENGTH, FT)

Type of elbow fitting	I.D. (in.)		
	3/4	7/8	1-1/8
90° short radius	1.7	2	2.3
90° long radius	1.5	1.7	1.6
45°	0.7	0.8	1

Installation Requirements

1. In a completely horizontal installation with a long line set where the evaporator is at the same altitude as (or slightly below) the condenser, the line set should be sloped towards

the evaporator. This helps reduce refrigerant migration to the condenser during a system's off-cycle.

2. For a system installation where the evaporator is above the condenser, an inverted vapor line trap should be installed on the suction line just before the inlet to the evaporator (see Fig 1). The top of the inverted loop must be slightly above the top of the evaporator coil and can be created simply by brazing two 90° long radius elbows together, if a bending tool is unavailable. Properly support and secure the inverted loop to the nearest point on the indoor unit or adjacent structure.

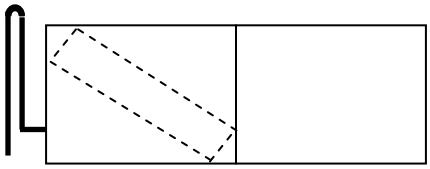

Fig 1. Evaporator unit with inverted vapor loop

3. **An oil trap is required at the evaporator only if the condenser is above the evaporator, and the height difference is more than 15ft.** Preformed oil traps are available at most HVAC supply houses, or oil traps may be created by brazing tubing elbows together (see diagram below). Remember to add the equivalent length from oil traps to the equivalent length calculation of the suction line. For example, if you construct an oil trap using two 45° elbows, one short and one long 90° elbow in a ¾" diameter suction line, the additional equivalent length would be 0.7+ 0.7+1.7+1.5, which equals 4.6 feet (refer to Table 3).

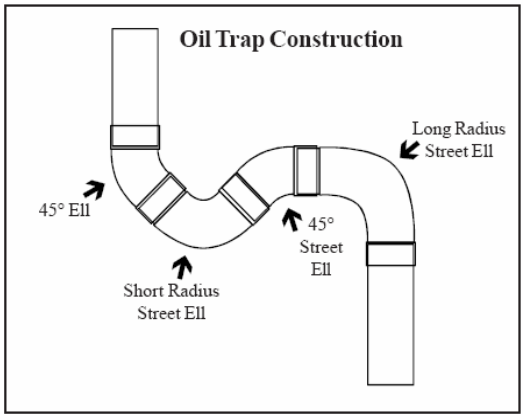

Fig 2. Oil Trap

4. **Low voltage wiring**. Verify low voltage wiring size is adequate for the length used since it will be increased in a long line application.

Initial System Charging

R-410A condensers are factory charged for 15 feet of line set. To calculate the amount of extra refrigerant (in ounces) needed for a line set over 15 feet, multiply the additional length of line set by 0.6 ounces. Note for the formula below, the linear feet of line set is the actual length of liquid line (or suction line, since both should be equal) used, not the equivalent length calculated for the suction line.

Use subcooling as the primary method for final system charging of long line set system application.

Extra refrigerant needed = (Linear feet of line set – 15 ft) x **X** oz/ft. Where **X** = **0.6** for 3/8" liquid tubing.

Remember, 3/8” liquid tubing is required for all long line set applications.

Heat pumps should be checked in both heating and cooling mode for proper charge level. This guideline is meant to provide installation instructions based on most common long line set applications. Installation variables may affect system operation.

NO ADDITIONAL COMPRESSOR OIL IS NEEDED FOR LONG LINE SET APPLICATIONS ON RESIDENTIAL SPLIT SYSTEMS.